

V. A LIST OF THE FRESH WATER FISHES OF WESTERN
PANAMA BETWEEN LONG. $81^{\circ} 45'$ and $83^{\circ} 15' W.$

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(PLATES XVIII—XIX MAP)

The fishes here listed were collected in northern, *i. e.* western, Panama between Long. 81° and $45'$ and $83^{\circ} 15' W.$ during the summer of 1921 and the winter months (January to March) 1923. With the exception of the northernmost portion of the territory, being that part of Costa Rica just across the Panaman border, this region had not been covered by previous collectors. F. M. and H. T. Gaige collected in the region of Chiriqui at almost the same time as we did, and, so far at least as some of the Cyprinodonts are concerned, their collection appears to overlap ours to a slight degree, although we did not meet them nor collect at any time with them in exactly the same territory. Our material from that region, as will be seen from the list below and the appended map, was all from the eastern (Atlantic) side, with the exception of what was collected on the Pacific slope between 7000 ft. and about 3000 ft. above sea-level, in the valley of the Rio Chiriqui del Tire, descending the slope as far as the neighborhood of the town of Caldera.

I am greatly indebted to the late Dr. C. H. Eigenmann of Indiana University, not only for encouragement and assistance in making plans for carrying on the collection, but for much help and many valuable suggestions in the identification of the material, which was completed in the laboratories of Indiana University. The material representing the Cyprinodonts was put into the hands of Dr. C. L. Hubbs of the University of Michigan. I am greatly indebted to him for the identification of our representatives of this family of fishes, and am authorized by him to incorporate in this paper his data published more fully elsewhere, just as they were given to me.

I am greatly indebted to the officials and employees of the United Fruit Company in New Orleans and in the State of Panama for much valuable advice and mechanical help; to the various members of the Department of Zoölogy in residence at Indiana University during the

summer of 1924; and to the administration of the Louisiana State University for making it possible for me to leave my academic duties during the second year in order to complete my collections. The list of acknowledgments would be incomplete without expressing very warm appreciation of the services of my assistant on the second trip, Miss Jessie Chambers, a senior student at Louisiana State University, whose unfailing pluck and energy made easy a trip, which had promised to be very difficult.

LIST OF LOCALITIES AT WHICH COLLECTIONS WERE MADE.

ATLANTIC SLOPE.

Fruitdale Dam, Fruitdale Creek and tributaries; Western River, Quebrada Nigua, Cedar Creek, Banana River, Shepard Creek, and all their tributaries and swamp feeders.

San-San River and its swamp feeder, Rio Changuinola, and its old bed, now a lagoon.

Rio Sixaola and its tributaries, including Rio Coen, Rio Lari, Rio Tiliri, Rio Zepeque (Costa Rica) and Rio Zhorkin (Panama).

Rio Guarumo and its tributaries, including Rio Guabito.

Rio Cricamola from ten miles above mouth to Conquantu (Konkintu), and small streams tributary to it just above and below Conquantu.

PACIFIC SLOPE.

Rio Chiriqui del Tire; Quebrada I. Letra, Copera, Salão, Sombrero, and Chiriquisito, all tributaries of the above river.

LIST OF FISHES ARRANGED ACCORDING TO FAMILIES

Family SILURIDÆ

Genus RHAMDIA, Bleeker.

1. *Rhamdia godmani* (GÜNTHER).

Pimelodus godmani GÜNTHER, Cat. Fishes B. M., V, 1864, 124, (Mexico; Guatemala, R. Motagua).

Rhamdia godmani JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, I, 1896, 152.

Fourteen specimens, all from small streams tributary to Rio Cricamola near Conquantu (Konkintu). (Three of these specimens in Carnegie Museum, C. M. Cat. Fishes, No. 8510).

These specimens most nearly answer the description of *R. godmani* Jordan and Evermann (25)* and Regan (42), except that they differ

*The numbers in parentheses refer to the appended Bibliography.

in the length of the barbels. As in every other respect the specimens very closely resemble *R. godmani*, we refer the material to this species. It is true that *R. godmani* has heretofore only been described from as far south as Honduras, and then only from the Pacific coast. Our specimens are all from the eastern coast and only from the southernmost range of our territory. The adipose fin in our material ascends very gradually from under the posterior limit of the dorsal rays, when these are flattened backward; there is a considerable distance (perhaps one-third the length of the dorsal or more) between the posterior extremity of the dorsal and the origin of the adipose. Since this relationship of the fins is intermediate between that of *R. wagneri* and that of *R. underwoodi*, one conceivably might interpret our *R. godmani* as being a new, not yet well established species intermediate between the other two. Geographical data, however, make such an interpretation questionable. It is to be noted that *R. wagneri* is a southern form, not reported north of our territory at its northern limit in Costa Rica. *R. underwoodi* seems to be of limited distribution occurring only in Costa Rica, to the north of our *R. godmani* and of all specimens hitherto reported as being *R. wagneri*. It is not quite clear to us why we should find a northern Pacific-coast form only at the southern Atlantic-coast limit of our territory, especially since all members of the genus *Rhamdia* spread very readily and widely. Our references of this material to this species therefore must inevitably be regarded as tentative.

2. *Rhamdia wagneri* (GÜNTHER).

Pimelodus cinerascens (non GÜNTHER) KNER and STEINDACHNER, K. Bayer. Ak. Wiss. Muenchen, 1865, 49 (Panama).

Pimelodus wagneri GÜNTHER, Trans. Zoöl. Soc. London, Vol. VI, 1868, 474 (Atlantic and Pacific rivers of Panama); Steindachner, Denkschr. K. K. Ak. Wiss. Wien, XLI, 1879, (Rio Mamoni, Crepo, Panama).

Rhamdia bransfordi GILL, Proc. Ac. Nat. Sci. Phila., 1876, 337 (Panama).

Rhamdia wagneri EIGENMANN and EIGENMANN, Occ. Pap. Cal. Ac. Sci., I, 1890, 133, (Gorgona, Rio Chagres; Rio Obispo, Panama; Turbo, Atlantic coast of Central America); JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1896, 151; REGAN, Biol. Centr.-Am., Pisces, 1907, 131 (Shirures, Costa Rica; Western Ecuador).

Thirty-three specimens from streams tributary to Rio Cricamola near Conquantu (Konkintu), including four specimens deposited in the Carnegie Museum (C. M. Cat. Fishes, No. 8511); sixteen specimens from streams emptying into Almirante Bay, three of which are in Carnegie Museum (Cat. Fishes No. 8512); two specimens from the Pacific slope, taken in a small stream tributary to Rio Chiriqui; four specimens from streams of upper Costa Rica emptying into Rio Sixaola.

The descriptions of *R. wagneri* in the literature do not indicate such a heavy sturdy pectoral spine as occurs without exception in our material. The description of *R. heterocantha* (Regan) (42) gives just such pectoral thorns as occur in our material. On the other hand, specimens of *R. wagneri* from Gatun, C.Z., in the Indiana University Museum, have just such spines with just such thorns, or serrations, as our material. We therefore refer our specimens to the more generally known species, expressing doubt as to whether *R. heterocantha* is justly to be regarded as specifically different.

3. *Rhamdia underwoodi* Regan.

Rhamdia underwoodi REGAN, Biol. Centr.-Am., Pisces, 1906, 135 (Costa Rica, Juan Viñas).

Twenty specimens, all from small streams emptying into Rio Cricamola near Conquantu (Konkintu), of which four specimens are cataloged, C. M. Cat. Fishes, No. 8513.

We refer these specimens to *R. underwoodi*, hitherto described only from Costa Rica. Our material differs from the type only in a slight variability in the number of the anal rays.

Genus PIMELODELLA Eigenmann & Eigenmann.

4. *Pimelodella chagresi* (Steindachner).

Pseudorhamdia chagresi STEINDACHNER, Sitzb. K. K. Akad. Wiss. Wien, LXXIV, 1876, 584 (Rio Chagres and its tributaries).

Pimelodella chagresi EIGENMANN and EIGENMANN, Proc. Cal. Acad. Sci. 2nd. Ser., 1, 1888, 134 (Rio Obispo), and Occ. Pap. Cal. Ac. Sci., 1, 1890, 160 (R. Chagres and its tributaries).

Forty-three specimens, all from small streams tributary to Rio Chiriqui del Tire, Pacific slope, including eight specimens (C. M. Cat. Fishes, No. 8514).

According to Eigenmann (4) the description of the distribution of *P. chagresi* is "Both slopes of Panama, Atrato and Magdalena Basins." Our specimens extend the previous limits considerably northward. There are certain points in which our specimens differ from typical *P. chagresi*, notably in that in our examples the adipose and the maxillary barbels are a little short. We have compared specimens in the Indiana University Museum of various sizes. Eigenmann (4) p. 231, says of *Pimelodella* and *Typhlobagrus*: "The length of barbels in the same species differs with the age. In the young the barbels are relatively short, grow longer with the growth of the fish, and then lag behind again in their increase in length. The length of barbels of the same species differs not only with age, but sometimes also with locality. Pectoral spines also vary somewhat in growth. With age the thorns increase in number by the addition of new ones towards the tip, and come to occupy a larger portion of the length of the spine.

The spine increases in length by the addition of new sections at the end, which are marked off by notches or hooks on the outer margin of the spine. The color and the size of the eye also vary with age and with locality, and all of these characters vary independently."

Family PYGIDIIDÆ

Genus PYGIDIUM Meyen.

5. *Pygidium septentrionale* sp. nov. (Pl. XVIII).

This fish is closely related to *P. striatum spilosoma*, and *P. unicolor* among the most northern species of *Pygidium*. *P. striatum* occurs in the Tuyra Basin; *P. unicolor* and *P. spilosoma* in the Pacific drainage in Central Colombia (the San Juan and Dagua rivers). Our specimen differs strikingly from these in the width of the head.

Head at least as broad as long; distance from chin to nearest point of gill, half the width of the head. Length of the head 6 to nearly 7 in length to base of caudal. Diameter of eye 3 in interocular width. Maxillary barbels reaching to origin of pectorals or shorter. Teeth conical, sharply pointed. Dorsal, caudal, and anal fins truncate. Pectoral filament short. Origin of dorsal above or a little in advance of vent and equidistant from tip of caudal and pre-opercle; distance from caudal nearly 2 in its distance from snout. Last dorsal ray over anal, but not over last. Origin of ventrals nearer tip of pectoral filament than caudal. Color slate inclining to brownish, mottled, especially below. Belly also dark.

Twelve specimens, ranging from 69 to 110 mm. to base of caudal, taken from small streams tributary to Rio Chiriqui del Tire above Caldera, Pacific slope of Panama, altitude about 4,000 feet.

The type, Carnegie Museum Cat. Fishes, No. 8515, is a specimen 90 mm. to base of caudal from Quebrada Salão; a paratype, C. M. Cat. Fishes, No. 8516, 79 mm. to caudal base, is from Quebrada Sombrero.

6. *Pygidium striatum* Meek and Hildebrand.

Pygidium striatum MEEK and HILDEBRAND, Field Mus. Nat. Hist. Publ. Zool. Ser., X, 1913, 78 (Rio Cana, Panama).

One specimen from a small stream, tributary to Rio Chiriqui del Tire, Pacific slope.

This species has so far not been described as occurring above the Tuyra Basin.

Family GYMNOTIDÆ

Genus HYPOPOMUS Gill.

7. *Rhampichthys brevirostris* (Steindachner).

Rhampichthys brevirostris STEINDACHNER, Sitzb. K. K. Ak. Wiss. Wien, LVIII, 1868, 254, Pl. II, Fig. 2 (Rio Guaporé); GÜNTHER, Cat. Fish. Brit. Mus.,

VIII, 1870, 6; STEINDACHNER, Denkschr. K. K. Ak. Wiss. Wien, XLI, 1880, 89 (Rio Guaporé, Amazon; stream near Santarem, and Rio Cauca).

Brachyrhamphichthys brevirostris EIGENMANN and EIGENMANN, Proc. U. S. N. M., XIV, 1891, 62.

Hypopomus brevirostris EIGENMANN and KENNEDY, Proc. Ac. Nat. Sci. Phila., 1903, 530 (Campo Grande, Arroyo Chagalalina); Ellis, Mem. Carnegie Mus., VI, 1913, 134, fig. 7; EIGENMANN and FISHER, Indiana University Studies, No. 25, 1914, 236 (Rivers of Colombia).

Hypopomus occidentalis REGAN, Ann. and Mag. Nat. Hist., (8) XIV, 1914, 32.

Forty-seven specimens, all from small streams emptying into Rio Cricamola near Conquantu (Konkintu) including seven specimens in Carnegie Museum (Cat. Fishes, No. 8517).

Genus GYMNOTUS Linnæus.

8. *Gymnotus carapo* Linnæus.

Gymnotus carapo Linnæus, Syst. Nat., Ed. X, 1758, 246, and Ed. XII, 1766, 427; MEEK, Publ. Field Mus. Nat. Hist.; Zool. Ser., Vol. VII, 1907, 135 (Los Amates and Lake Amatitlan, Guatemala); Ellis, Mem. Carnegie Mus. VI, 1913, 117 (Guatemala, South to the Rio de la Plata, and also in the West Indies).

Two specimens from a small stream tributary to Rio Cricamola, near Conquantu (Konkintu).

We find no dorsal filaments such as are usually attributed to this species in descriptions, but Ellis (13) describes none for *G. carapo*.

Family ANGUILLIDÆ

Genus ANGUILLA Thunberg.

9. *Anguilla chrysypa* Rafinesque.

Anguilla chrysypa RAFINESQUE, Am. Month. Mag. and Crit. Rev., 1817, 120, (Lake George; Hudson River; Lake Champlain).

Nine specimens from small streams emptying into Almirante Bay.

Family GOBIIDÆ

Genus DORMITATOR Gill.

10. *Dormitator maculatus* (Bloch).

Sciæna maculata BLOCH, Naturgesch. der Auslând. Fische, 1790 (West Indies).

Dormitator maculatus (in part) JORDAN and GILBERT, Bull. U. S. N. M., XVI, 1883, 632; JORDAN and EVERMANN, Proc. U. S. Nat. Mus., XLVII, 1898, 2196; REGAN, Biol. Centr.-Am., Pisces, 1905, 8, (in part).

One specimen, taken in a small tidal creek emptying into Almirante Bay.

Genus PHILYPNUS Valenciennes.

11. *Philypnus dormitor* (Lacépède).

- Gobiomorus dormitor* LACÉPÈDE, Hist. Nat. Poissons, II, 1798, 599 (Martinique);
 JORDAN and EIGENMANN, Proc. U. S. N. M., IX, 1886, 482.
Philypnus dormitor CUVIER and VALENCIENNES, Hist. Nat. Poiss. XII, 1837,
 255; Poey, Mem. II, 1860, 81; REGAN, Biol. Centr.-Am., Pisces, 1906, 5.
Philypnus dormitor JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, 1894,
 2194; MEEK and HILDEBRAND, Publ. Field Col. Mus. Nat. Hist. Zööl., Ser., X,
 1916, 350 (Chagres Basin).

Sixteen specimens, Rio Chauguinola, Rio San-San, and small streams into lower Rio Sixaola and into Almirante Bay, of which two specimens from San-San River are in the Carnegie Museum (Cat. Fishes, No. 8518); one specimen, Rio Cricamola, lower course; one specimen, Rio Zhorkin, tributary of upper Rio Sixaola.

The color variations in this group are great, and apparently correlated with size. The larger specimens show the less regular spotting, and never the distinct lateral band (confluent spots) characteristic of the smaller specimens. But always among the smaller fishes the ground-color shows great variability in the degree of yellow and pink.

Genus AWAOUS Steindachner.

12. *Awaous taiasica* (Lichenstein).

- Gobius taiasica* LICHENSTEIN, Akad. Wiss. Berl., Abhandl., 1822, 273 (Brazil).
Awaous taiasica MEEK and HILDEBRAND, Publ. Field Col. Mus. Nat. Hist.,
 (Zööl.), X, 1916, 366 (Chagres Basin).

Three specimens from creeks emptying into Almirante Bay.

Genus GUAVINA Bleeker.

13. *Guavina guavina* (Cuvier and Valenciennes).

- Eleotris guavina* CUVIER and VALENCIENNES, Hist. Nat. Poiss., XII, 1837, 223
 (Martinique); GÜNTHER, Cat. Fish. Brit. Mus., III, 1861, 124 (Demerara);
 REGAN, Biol. Centr.-Am., Pisces, 1905, 7.
Guavina guavina EIGENMANN and FORDICE, Proc. Ac. Nat. Sci. Phil., 1885, 73;
 JORDAN and EIGENMANN, Proc. U. S. N. M., IX, 1886, 482; JORDAN and EVER-
 MANN, Bull. U. S. N. M., XLVII, 1898, 2194.

Eight specimens from small streams and the San-San River emptying into Almirante Bay and thence northward to Costa Rica over the Atlantic slope; one specimen from San-San River (C. M. Cat. Fishes

No. 8519); one specimen, *Rio Cricamola*, about ten miles above its mouth.

Genus *Gobius* Linnæus.

14. *Gobius claytoni* Meek.

Gobius claytoni MEEK, Field Col. Mus. Publ. 65, 1902, 121, (La Antigua); Zoöl. Ser. V, 231 (Vera Cruz, San Francisco; Boca del Rio).

Two specimens from small streams emptying into Almirante Bay.

Genus *Sicydium* Valenciennes.

15. *Sicydium pittieri* Regan.

Sicydium pittieri REGAN, Ann. Mag. Nat. Hist. (7) XIX, 1907, 260 (Costa Rica; Rio Grande de Terraba).

Six specimens from a small stream tributary to Rio Chiriqui del Tire, Pacific slope, including one specimen (C. M. Cat. Fishes, No. 8520.)

16. *Sicydium salvini* Grant.

Sicydium salvini GRANT, Proc. Zoöl. Soc. Lond., 1884, 159 (Panama).

Four specimens from Shepard Creek emptying into lower Almirante Bay, including one specimen (C. M. Cat. Fishes, No. 8521).

One specimen from a small creek emptying into Rio Tiliri, upper Costa Rica.

Family *MUGILIDÆ*.

Genus *AGONOSTOMUS* Bennett.

17. *Agonostomus macracanthus* Regan.

Agonostomus macracanthus REGAN, Ann. and Mag. Nat. Hist., (7) XIX, 1907, 65; and Biol. Centr.-Am., Pisces, 1907, 69, Pl. XI, fig. I (Rio Guacalate, Guatemala).

Ten specimens, from streams tributary to Rio Cricamola, near Conquantu; one specimen, from Rio Guarumo emptying into Chiriqui Lagoon; four specimens, from small streams discharging into Almirante Bay; three specimens, from a small stream emptying into Rio Tiliri, Costa Rica.

18. *Agonostomus monticola* (Bancroft).

Mugil monticola BANCROFT, in Griffith's Edition of Cuvier's Animal Kingdom, Fishes, 1836, 367, Pl. 36 (West Indies).

Agonostoma monticola GÜNTHER, Cat. Fish. Brit. Mus., III, 1861, 464 (West Indies).

Agonostoma nasutum GÜNTHER, Cat. Fish. Brit. Mus., III, 1861, p. 463 (Rio San Geronimo, Guatemala); and Trans. Zoöl. Soc. London, Vol. VI, 1868, 444, Pl. 70, fig. 2.

Neomugil digueti VALLIANT, Bull. Soc. Philom., (8) VI, 1894, 73 (Lower Calif.).

Agonostoma monticola JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, 1896, 819, fig. 347; REGAN, Biol. Centr.-Am., Pisces, 1907, 66; MEEK, Field Mus. Nat. Hist. Publ., Zoöl. Ser. X, 1914, 118 (both slopes of Costa Rica).

Agonostomus nasutus JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1896, 819; REGAN, Biol. Centr.-Am., Pisces, 1907, 68, Pl. X, fig. 4.

One specimen from creek tributary to Rio Cricamola near Conquantu; sixteen specimens from creeks tributary to Rio Chiriqui del Tire, Pacific slope, including three specimens (C. M. Cat. Fishes, No. 8522); five specimens from streams discharging into Rio Sixaola and Almirante Bay; one specimen from Zhorkin River, tributary to Rio Sixaola.

Genus JOTURUS Poey.

19. *Joturus pichardi* Poey.

Joturus pichardi POEY, Mem., II, 1861, 263 (Cascades throughout Cuba); JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, 1896, 821; REGAN, Biol. Centr.-Am., Pisces, 1907, 70; MEEK, Field Mus. Nat. Hist. Publ., Zoöl. Ser. X, 1914, 117 (both slopes of Costa Rica).

Agonostoma globiceps GÜNTHER, Ann. and Mag. Nat. Hist. (4) XIV, 1874, 370 (Myzantla, Vera Cruz).

Joturus stipes JORDAN and GILBERT, Proc. U. S. N. M., V, 1882, 373 (Rio Bayano, Panama).

Xenorhynchichthys stipes REGAN, Ann. and Mag. Nat. Hist. (8), II, 1908, 461 (Rio Iroquois, Costa Rica).

One specimen, Rio Cricamola below Conquantu (Konkintu); seventeen specimens, Rio Guarumo at Punta Pina (including four specimens, C. M. Cat. Fishes, No. 8523); two specimens, Shepard Creek emptying into lower Almirante Bay; thirty-four specimens, very small, apparently young, with much yellow color on fins, taken in a small creek emptying into Rio Tiliri, upper Costa Rica (including six specimens, C. M. Cat. Fishes, No. 8524).

ATHERINIDÆ

Genus THYRINOPS Hubbs.

20. *Thyrinops (Thyrina) pachylepis* (Günther).

Atherinichthys pachylepis GÜNTHER, Proc. Zoöl. Soc. London, XXIV, 1864, p. 25.

Menidia pachylepis JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, Pt. 1, 1896, 801.

(*Thyrina*) *pachylepis* JORDAN and EVERMANN, *ibid*, Pt. 3, 1898, p. 2840.

Kirtlandia pachylepis GILBERT and STARKS, Mem. Cal. Acad. Sci., IV, 1904, 37; STARKS, Proc. U. S. N. M., XXX, 1906, 783.

Thyrinops pachylepis HUBBS, Proc. Acad. Nat. Sci. Phila., LXIX, 1918, 307 (Panama).

Four specimens from a creek tributary to Rio Tiliri, Costa Rica, Atlantic slope; five specimens from Rio Cricamola at Conquantu; three specimens from upper Rio Changuinola near Costa Rican border, Atlantic slope; three specimens, Western River, emptying into Almirante Bay; thirty-four specimens from streams tributary to Rio Sixaola, upper Panama, Atlantic slope (including six specimens, C. M. Cat. Fishes, No. 8525).

These fishes have so far been described as inhabiting only the Pacific slopes and streams from Costa Rica to Ecuador, and the Atlantic watershed only from Venezuela southward. We found them only in the Atlantic streams.

GOBIESOCIDÆ

Genus GOBIESOX Lacépède.

21. *Gobiesox costaricensis* Meek.

Gobiesox costaricensis MEEK, Publ. Field Mus., Zoöl. Ser. X, 1912, 74 (Zent, Costa Rica; Parismina, Turruhales).

Four specimens from a small stream tributary to Rio Cricamola near Conquantu.

These fishes have hitherto not been described from points farther south than Mexico, where Regan reports Pellegrin as having found them in rapid streams tributary to the Rio Grande de Santiago. We found the specimens in very shallow, very rocky stream-beds, clinging to rocks in swiftly moving water.

SCIÆNIDÆ

Genus BAIRDIELLA Gill.

22. *Bairdiella armata* Gill.

Bairdiella armata GILL, Proc. Ac. Nat. Sci. Phila., 1863, 164 (West Coast of Central America).

Corvina acutirostris STEINDACHNER, Zur Fishfauna des Magdalenenstromes, 1870, 9; Ichth. Beitr. III, 1875, 28, (Panama).

Bairdiella armata JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, 1898, 1436.

Ten specimens from a small stream emptying into Almirante Bay (including two specimens, C. M. Cat. Fishes, No. 8526).

CENTROPOMIDÆ

Genus CENTROPOMUS Lacépède.

23. *Centropomus parallelus* Peoy.*Centropomus parallelus* POEY, Mem. Cuba, II, 1860, 126; and Repert. II, 1868, 280.*Centropomus undecimalis* (part) GÜNTHER, Cat. Fish. of B. M. I, 1859, 79.

Seventeen specimens from Rio Changuinola and smaller streams discharging into Almirante Bay (including three specimens, C. M. Cat. Fishes, No. 8527).

HÆMULIDÆ

Genus POMODASYS Lacépède.

24. *Pomadasys crocro* (Cuvier and Valenciennes).*Pristipoma crocro* CUVIER and VALENCIENNES, Hist. Poiss., V, 1830, 264.*Pomadasys crocro* JORDAN and EVERMANN, Bull. U. S. N. M., XLVII, 1898, 1333.*Pomadasys starri* MEEK, Publ. Field Col. Mus. (Zool.) V, 1904, 200.

Thirteen specimens from Rio Zhorkin, emptying into the upper Sixaola (including three specimens, C. M. Cat. Fishes, No. 8528); two specimens from San-San swamp and a small stream discharging into Almirante Bay; twenty-seven specimens from Rio Cricamola ten miles above mouth (including five specimens, C. M. Cat. Fishes, No. 8529); two specimens from small stream emptying into Rio Cricamola near Conquantu.

PÆCILIIDÆ

Genus BRACHYRHAPHIS Regan.

25. *Brachyrhaphis terrabensis* Regan.*Gambusia terrabensis* REGAN, Ann. Mag. Nat. Hist. (7) XIX, 1907, p. 260; Biol. Centr.-Am., Pisces, 1907, p. 97, pl. 12, fig. 7.*Pseudoxiphophorus terrabensis* REGAN, Proc. Zool. Soc. London, 1913, p. 993.

Fifty-nine specimens from streams tributary to Rio Chiriqui del Tire, Pacific slope of Panama.¹

26. *Brachyrhaphis cascajalensis* Meek and Hildebrand.*Gambusia cascajalensis* MEEK and HILDEBRAND, Publ. Field Mus., (Zool.) X, 1913, p. 86; X, 1916, p. 318; EIGENMANN, Mem. Carn. Mus., IX, 1922, p. 180.

One hundred and ninety-three specimens from Caribbean slope of Panama and Costa Rica on each side of the frontier.

¹F. M. and H. T. Gaige in March, 1923, collected somewhat farther down the Pacific slope than the field covered in this report. I understand from their notes, to which I was kindly given access by Dr. Hubbs, that *Brachyrhaphis terrabensis* REGAN was the only species common to the two collections, theirs and mine.

Genus *TRIGONOPHALLUS* Hubbs.27. *Trigonophallus punctifer* Hubbs.

T. punctifer HUBBS, Misc. Publ. Univ. Mich. (Mus. Zoöl.) XVI, 1926, p. 49.

Type, a male from Guibari Creek, a tributary of the Rio Cricamola, below Conquantu, on the Caribbean slope of Panama. Paratypes, all females: three taken at the type locality; four in Nomonuen Creek discharging into Rio Cricamola below Conquantu, and another in the upper course of Western River, flowing into Almirante Bay, Panama. (Hubbs, 1926).

Genus *PRIAPICHTHYS* Regan28. *Priapichthys annectens annectens* Regan.

Gambusia annectens REGAN, Ann. Mag. Nat. Hist., (7) XIX, 1907, p. 259; Biol. Centr.-Am., Pisces, 1907, p. 97, pl. 14, figs. 5-7.

Priapichthys annectens REGAN, Proc. Zoöl. Soc. London, 1913, p. 992, fig. 170b; MEEK, Publ. Field Mus., (Zoöl.) X, 1914, p. 114 (in part).

Priapichthys annectens annectens HUBBS, Misc. Publ. Mus. Zoöl., Univ. Mich., XIII, 1924, p. 20.

Two specimens from Skoon Creek, a tributary of Rio Tiliri, Costa Rica, near the Panama border.

Genus *AULOPHALLUS* Hubbs.29. *Aulophallus retropinna* Regan.

Pæcilia retropinna REGAN, Ann. Mag. Nat. Hist., (8) II, 1908, p. 458.

Pæciliopsis retropinna REGAN, Proc. Zoöl. Soc. London, 1913, p. 997.

Twenty-two specimens from the Pacific side of western Panama, all in streams tributary to the Rio Chiriqui del Tire.

Genus *PHALLICHTHYS* Hubbs.30. *Phallichthys pittieri* Meek.

Pæcilia pittieri MEEK, Publ. Field Mus., (Zoöl.) X, 1912, p. 71.

Pæciliopsis pittieri REGAN, Proc. Zoöl. Soc. London, 1913, p. 997; MEEK, Publ. Field Col. Mus., (Zoöl.) X, 1914, p. 115.

Phallichthys pittieri MYERS, The Fish Culturist, 4, 1925, p. 370.

Pæciliopsis isthmensis REGAN, l. c., 1913, p. 997, pl. 100, figs. 3 and 4, text-fig. 161B; MEEK and HILDEBRAND, Publ. Field Mus., (Zoöl.) X, 1916, p. 325.

Phallichthys isthmensis MYERS, The Fish Culturist, 4, 1925, p. 371.

Twenty-five specimens from Skoon Creek, a tributary to the Rio Tiliri and from streams in western Panama into Almirante Bay and Chiriqui Lagoon.

Genus *MOLLINIENISIA* LeSeuer.31. *Mollienisia sphenops* (Cuvier and Valenciennes).

Mollienisia sphenops MEEK and HILDEBRAND, Field Mus. Nat. Hist. Publ., Zool. Ser. X, 1916, p. 326, fig. 10 (both slopes of Panama); HENN, Ann. Carn. Mus., X, 1916, p. 136 (Cartagena; Rio Manzanares; Santa Marta, Colombia).

Twenty-eight specimens, from small streams tributary to Rio Cricamola near Conquantu; twenty-four specimens, from Rio San-San and swamp; thirty-three specimens, from small streams into Almirante Bay; fifty-five specimens, from creeks emptying into Rio Tiliri, Costa Rica.

Genus *ALFARO* Meek.32. *Alfaro cultratus* Regan.

Eight specimens from small streams emptying into Almirante Bay; one specimen from San-San River and swamp; one specimen from Rio Cricamola below Conquantu; one specimen from small creek into Rio Tiliri, Costa Rica.

Family CHARACIDÆ

Genus *BRYCON* Müller & Troschel.33. *Brycon striatulus* (Kner).

Chalcinopsis striatulus KNER, Sitzber. Bayer. Ak., 1863, 226; GÜNTHER, Cat. Fish. V, 1864, 337 (Costa Rica, Juan Vinas and El Pozodel, Rio Grande).

Chalcinopsis chagrensis KNER, l. c., 338 (Rio Chagres, Panama).

Chalcinopsis striatulus KNER and STEINDACHNER, Neue Fische aus Centr.-Am., Abh. Bayer. Ak. Wiss. Muenchen, 1864, 38 (New Granada, Pacific side of Panama).

Brycon striatulus EIGENMANN and EIGENMANN, Proc. U. S. Nat. Mus., XLVII, 1896, 37; REGAN, Biol. Centr.-Am., Pisces, 1908, 169 (Juan Vinas, etc.).

Sixty-seven specimens, all from creeks feeding into Rio Chiriqui del Tire, Pacific slope, or from the main river (including fourteen specimens, C. M. Cat. Fishes, No. 8530).

These fishes do not agree with *B. striatulus* Kner, nor entirely with specimens of *B. striatulus* from the Indiana University Museum, chiefly in tooth arrangement and size. Our material has but two rows of teeth laterally, whereas in *B. striatulus* from Barbacoas and from Rio Telembi above Barbacoas, they are always in three rows laterally. Our material differs from Eigenmann's *B. striatulus* (1) in that the outer series in the lower jaw consists of four or five large teeth and many smaller ones, usually of two sorts, the tricuspid grading off followed by a sudden break and then very small pointed teeth; Eigenmann describes "8, rarely 7 to 9," in the outer series of the lower jaw.

There also seems to be some difficulty about the distribution, Meek and Hildebrand give that of *B. striatulus* as the Pacific slope; it will be noted that all our material was also collected on the Pacific slope.

34. ***Brycon guatemalensis* Regan.**

Brycon guatemalensis REGAN, Biol. Centr.-Am., Pisces, 1908, 168.

Regan recorded this species, originally referred to *Chalcinopsis dentex* by Günther from Rio Chisoy, Rio Usumacinta, Rio Motagua, and Lake Yzobal. We secured the following:

Six specimens from Rio Guarumo and tributary into Chiriqui Lagoon (including one specimen, C. M. Cat. Fishes, No. 8531); three specimens from tributaries of Rio Cricamola emptying into Chiriqui Lagoon.

My specimens differ from Regan's in that his material seems somewhat stouter and possibly smaller-headed; there are also slight differences in the longi- and vertical scale count. Eigenmann in his key to the Indiana Museum Fishes says: "It is very probable that *B. argenteus* of Meek and Hildebrand is identical with this species."

Genus *HYPHESSOBRYCON* Durbin.

35. ***Hyphessobrycon panamensis* Durbin.**

Hyphessobrycon panamensis DURBIN, Bull. M. C. Z., LII, 1908, 101 (Poqueron River, Panama).

Eighty-five specimens, small streams into Rio Cricamola into Chiriqui Lagoon, Atlantic slope (including fifteen specimens, C. M. Cat. Fishes, No. 8532); one specimen San-San River, Atlantic slope; one specimen from Rio Changuinola near Costa Rican border; one specimen taken in small stream emptying into Almirante Bay.

Genus *ROEBOIDES* Günther.

36. ***Roeboides guatemalensis* (Günther).**

Anacrytus guatemalensis GÜNTHER, Cat. Fish. Brit. Mus., V, 1864, 347 (Chagres; Huamuchal).

Roeboides guatemalensis EIGENMANN and EIGENMANN, Proc. U. S. Nat. Mus. XIV, 1891, 57; JORDAN and EVERMANN, Bull. U. S. Nat. Mus. XLVII, I, 1896, 338.

Twenty-four specimens from small creeks discharging into Rio Chiriqui del Tire, near Caldera, Pacific slope (including three specimens, C. M. Cat. Fishes, No. 8533).

These fishes have hitherto been described from the Caribbean coast. We found them only on the Pacific slope.

Genus *ASTYANAX* Baird & Girard.37. *Astyanax albeolus* Eigenmann.

Astyanax albeolus EIGENMANN, Bull. M. C. Z. 1908, 52, 97; Rept. Princeton University Exped. Patagonia, 1910, 3, 432.

Twenty-eight specimens, all from small streams emptying into Rio Chiriqui del Tire, near Caldera, Pacific slope (including two specimens, C. M. Cat. Fishes, No. 8534).

These fishes seem to be different from Eigenmann's *A. albeolus* only in that the body is slightly less compressed and more shallow, and that the anal fin count is occasionally below the type.

38. *Astyanax nicaraguensis* Eigenmann & Ogle.

Astyanax rutilus nicaraguensis EIGENMANN and OGLE, Proc. U. S. Nat. Mus. 1907, 3323.

Astyanax fasciatus nicaraguensis EIGENMANN, Rept. Princeton University Exped. Patagonia, 1910, 433.

Two specimens from Rio Tiliri, old bed, Costa Rica; six specimens from Rio Zepeque at Caen, Costa Rica (including one specimen, C. M. Cat. Fishes, No. 8535); three specimens from small streams discharging into Rio Cricamola near Conquantu; nine specimens from small streams emptying into Almirante Bay (including one specimen, C. M. Cat. Fishes, No. 8536); seventeen specimens from Rio San-San and its tributaries (including three specimens, C. M. Cat. Fishes, No. 8537).

39. *Astyanax æneus costaricensis* (Meek).

Astyanax arstedti MEEK, Publ. Field Mus. Zoöl., Ser. VII, 1907, 145.

Tetragonopterus æneus REGAN, Ann. and Mag. Nat. Hist. (8) I, 1908, 455, (*part*).

Astyanax æneus costaricensis MEEK, Field Mus. Nat. Hist. Zoöl. Ser., Publ. 174, X, 1914, 10.

Thirteen specimens, from Zegla creek emptying into Rio Teribe thence into upper Rio Changuinola (including three specimens, C. M. Cat. Fishes, No. 8538); forty-one specimens from San-San River and swamp (including five specimens, C. M. Cat. Fishes, No. 8539); five specimens from Creek and swamp into lower Rio Sixaola (including three specimens, C. M. Cat. Fishes, No. 8540); forty-four specimens from small streams and rivers discharging into Almirante Bay (including eight specimens, C. M. Cat. Fishes, No. 8541); two hundred and ninety-one specimens from Rio Cricamola above, below, and at Conquantu (including about fifty specimens, C. M. Cat. Fishes, No. 8542); five specimens from Rio Guabito and Rio Guarumo emptying into Chiriqui Lagoon.

I have studied for comparison specimens in the Indiana Museum from Los Amates, El Rancho (Rio Motagua), and Tenedores (Rio Tenedores). These specimens, like my own, show the origin of the dorsal slightly nearer the snout than the base of the caudal, and their anal count runs (Eigenmann, I) within the range exhibited by my specimens; likewise in their lateral line and in coloring they are exactly like my fishes.

Genus BRYCONAMERICUS Eigenmann.

40. **Bryconamericus peruanus ricæ** Eigenmann.

Bryconamericus peruanus ricæ EIGENMANN, Bull. Mus. Comp. Zool. LII, 1908, 100.

Twelve specimens, from tributaries of Rio Tiliri, at and above Coen, Costa Rica (including one specimen, C. M. Cat. Fishes, No. 8543); five specimens from Rio Guabito at Guagu above Punta Pina (including one specimen, C. M. Cat. Fishes, No. 8544); twenty-six specimens from Q. Guibari emptying into Rio Cricamola below Conquantu (including six specimens, C. M. Cat. Fishes, No. 8545).

Family CICHLIDÆ

Genus CICHLASOMA Swainson.

41. **Cichlasoma motaguense** (Günther).

Heros motaguensis GÜNTHER, Trans. Zool. Soc. Lond., VI, 1868, p. 462, pl. LXXVII, fig. 2.

Heros motaguensis (part) PELLEGRIN, Mem. Soc. Zool. France, XVI, 1903, 234.

Cichlasoma motaguense REGAN, Ann. and Mag. of Nat. Hist., (7) XVI, 1905, 336.

Thirty-two specimens from tributaries of Rio Cricamola emptying into Chiriqui Lagoon, Atlantic slope (including six specimens, C. M. Cat. Fishes, No. 8546); four specimens from tributaries emptying into lower Rio Sixaola, province of Panama, Atlantic slope; seventeen specimens from backwater pools and tributaries emptying into upper Rio Sixaola, Costa Rica, Atlantic slope (including one specimen, C. M. Cat. Fishes, No. 8547); seven specimens from tributaries of the Rio San-San and Rio Changuinola (C. M. Cat. Fishes, No. 8548); thirty-eight specimens from smaller streams on Atlantic slope emptying into Almirante Bay and northward to Costa Rican border (including one specimen, C. M. Cat. Fishes, No. 8549); two specimens from swamp pools near Edby Creek, Las Delicias (C. M. Cat. Fishes, No. 8550).

Regan reports his material from Panama, Pacific slope. It has likewise been reported from Rio Motagua, Atlantic slope, Guatemala.

42. *Cichlasoma altifrons* (Kner and Steindachner).

Heros altifrons KNER and STEINDACHNER, Zitzb. Ak. Bayer., 223, 1863, (Chiriqui, western Veragua).

Cichlasoma altifrons REGAN, Ann. and Mag. Nat. Hist. Ser. 7, XVI, 1905, (Rio Grande de Terraba, Costa Rica).

One specimen from Rio Zhorkin above Las Delicias; five specimens from small tributaries emptying into Rio Cricamola below Conquantu (including one specimen, C. M. Cat. Fishes, No. 8551); six specimens from Rio Tiliri near Caen, Costa Rica (including one specimen, C. M. Cat. Fishes No. 8552).

43. *Cichlasoma spilurum* (Günther).

Heros spilurum GÜNTHER, Cat. Fish. IV, 289, 1862.

Cichlasoma spilurum JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1520, 1898.

Thirty-six specimens from small streams emptying into Rio Cricamola near Conquantu (including six specimens, C. M. Cat. Fishes, No. 8553); two specimens from Rio Guarumo and its tributary Rio Guabito.

This species has hitherto been described no farther south than the Atlantic slope of Guatemala, Lake Yzobal and Rio Motagua, except in the Canal Zone. It is strange that we should have found no examples from any except the southern limit of our territory. The only Canal Zone specimen available for comparison had been injured anteriorly so seriously as to invalidate measurements.

44. *Cichlasoma guttulatum* (Günther).

Heros guttulatus GÜNTHER, Proc. Zool. Soc. 1864, 152; GÜNTHER, Tr. Zool. Soc. VI, 466, Pl. 78, fig. 3 (Lake Peten, Amatitlan).

Cichlasoma guttulatum PELLEGRIN, Mem. Soc. Zool. France, XVI, 1903, 214; Etude des Poissons de la Famille des Cichlides, 174, 1904.

Six specimens from Rio Cricamola ten miles above mouth (including one specimen, C. M. Cat. Fishes, No. 8554); nine specimens from small streams emptying into Rio Cricamola at Conquantu (including one specimen, C. M. Cat. Fishes, No. 8555); four specimens from Rio Guabito, at Guagu, above Punta Pina (including one specimen, C. M. Cat. Fishes, No. 8556); ten specimens from Rio Guarumo at Punta Pina (including two specimens, C. M. Cat. Fishes, No. 8557).

Our specimens differ from *C. guttulatum* (Regan, 41) in the greater depth of the head; in the smaller eye (5.8 instead of 3-4. 3); in the fewer gill-rakers (7 instead of 8-10); in the more completely truncated caudal; and in that the lower lip is not interrupted by a fold. The very vivid coloring of our specimens has not been described elsewhere;

our material is chiefly noteworthy for the vividness of the scarlet splotches and the intensity of the black spotting. We have referred examples to Dr. Regan for identification and he agrees with us in referring this material to *C. guttulatum*.

45. *Cichlasoma lethrinum* Regan.

Cichlasoma lethrinus REGAN, Ann. and Mag. Nat. Hist., (8) II, 1908, 462 (Rio Iroquois).

Five specimens, from Rio Tiliri and tributaries near Coen, Costa Rica; one specimen from Fruitdale Creek emptying into Almirante Bay.

This fish answers to Regan's general description of the genus *Herichthys*. Its teeth are subequal, the largest in the center; in the outer series of both jaws they grade off gradually toward the side; they are, however, not truly compressed over their whole extent, but merely at their apices, more cylindrical at their bases; not all their apices are pointed, but some unevenly rounded, as if they had been worn off. The same holds true of some teeth (irregular) of the inner series, others preserving their cichlasoma-like pointed, conical, and sometimes even curved character.

I have compared my material with Indiana University specimens of *Neetroplus panamensis* and *N. carpintis*, in neither of which cases do the teeth really resemble mine; for both Museum types are more extremely incisor-like than is the case in mine, and broader and more closely crowded. Likewise, both Indiana University species have deeper, thinner bodies, and smaller, thinner lips, and neither has the suggestion of a longitudinal band that appears in at least the larger of my specimens.

46. *Cichlasoma calobrense* Meek & Hildebrand.

Cichlasoma calobrense MEEK and HILDEBRAND, Field Mus. Nat. Hist. Publ., Zool. Ser. X, 1913, 90 (Rio Calobre, Panama).

One specimen from Rio Cricamola ten miles above mouth; ninety-four specimens from Rio Cricamola and tributaries near Conquantu, (including eighteen specimens, C. M. Cat. Fishes, No. 8558); sixty-three specimens from Rio San-San and tributaries, Atlantic slope (including thirteen specimens, C. M. Cat. Fishes, No. 8559); twenty-one specimens from Rio Sixaola and tributaries, upper Panama (including four specimens, C. M. Cat. Fishes, No. 8560); one specimen from Rio Zepeque near Coen, Costa Rica; seven specimens from Rio Guarumo above Punta Pina, Atlantic slope (including one specimen, C. M. Cat. Fishes, No. 8561).

Meek and Hildebrand report this fish only from the Pacific streams of Panama—Rio Calobre, Rio Bayano, and Rio Tuyra. Our larger

specimens appear to agree perfectly with their description, with the exception of rather unique color-marking not noted elsewhere, namely the very vivid iridescent turquoise-blue oblique stripes and dots found on the face (suborbital) and cheek. In spirits, this color is replaced by a dusky translucence easily overlooked. Our smaller specimens do not so much resemble the Indiana University specimens, but the differences may be accounted for as due to age, that is size. It is to be noted that the lips in our specimens are always interrupted.

47. *Cichlasoma nigrofasciatum* (Günther).

Heros nigrofasciatus (GÜNTHER), Cat. Fish. Brit. Mus., III, 1869, 452.

Cichlasoma nigrofasciatum JORDAN and EVERMANN, Bull. U. S. Nat. Mus. XLVII, 1898, 1525.

Twenty specimens from small streams emptying into Rio Cricamola near Conquantu (including two specimens, C. M. Cat. Fishes, No. 8562); eight specimens from small streams emptying into Almirante Bay (including one specimen, C. M. Cat. Fishes, No. 8563); four specimens from swamp draining into Rio Sixaola (including one specimen, C. M. Cat. Fishes, No. 8564); twelve specimens from San-San River and swamp (including two specimens, C. M. Cat. Fishes, No. 8565); one specimen from Rio Guarumo above Punta Pina; eleven specimens from Bioliri Creek emptying into Rio Lari, upper Costa Rica (including two specimens, C. M. Cat. Fishes, No. 8566).

These fishes were particularly marked by very striking coloration².

Genus PARANEETROPLUS Regan.

48. *Paraneetroplus sieboldii* Regan.

Paraneetroplus sieboldii REGAN, Ann. and Mag. Nat. Hist. Ser. 7, XVI, 1905, 235.

Forty specimens all from small streams emptying into Rio Chiriqui del Tire, above Caldera, Pacific slope (including seven specimens, C. M. Cat. Fishes, No. 8567).

Our specimens are probably the same fish as *P. sieboldii* from Costa Rica, Regan (45), not *C. sieboldii* from Panama. Regan (42) says: "Specimens of *C. sieboldii* (Kner and Steindachner) from Costa Rica

²Since this study was completed the above specimens have been subjected to a new and very careful analysis by Mr. G. S. Myers, of the Indiana University Museum. Mr. Myers does not agree with our reference of this fish to *C. nigrofasciatum*. According to Mr. Myers, the length of the maxillary and the depth of the fish prevent identification with *C. nigrofasciatum*; the long pectorals place it near *C. spilurum*; the only point of difference between it and *C. septemfasciatum* is the presence in my specimens of an extra bar and this last seems to Mr. Myers not significant. I cannot agree with this last point, since my material is very strikingly and consistently marked.

(Pittier) show that it is a *Paraneetroplus* and is the same as the species described under the name *Herichthys underwoodi*." Our specimens differ from *Cichlasoma* much as do Regan's *Paraneetroplus*, "only in dentition, all the teeth being broad, compressed, and pointed or rounded. The single species from Mexico is intermediate between *C. nebuliferum* and *Nectroplus nematopus*." Meek (34, P. 127) reduced Regan's *Herichthys underwoodi*, *Cichlasoma sieboldii* (non Steindachner), *Paraneetroplus sieboldii* Regan, *Cichlasoma frontale* Meek, all to synonymy. I feel that the distinction between *Paraneetroplus* and *Cichlasoma* in tooth structure is significant, and should be maintained, as does Regan (45) in calling his specimen *P. sieboldii*; Meek considers this tooth structure insignificant. I therefore use Regan's name.

Genus HEROTILAPIA Pellegrin.

49. *Herotilapia multispinosa* (Günther).

Heros multispinosus GÜNTHER, Tr. Zool. Soc. VI, 1869, 453, Pl. 74, fig. 2.

Cichlasoma multispinosum JORDAN and EVERMANN, U. S. Bull. Nat. Mus., XLVII, 1525, 1898; PELLEGRIN, Mem. Soc. Zool. France, XVI, 247, 1903.

Herotilapia multispinosa REGAN, Biol. Centr.-Am., Pisces, 1906, p. 31.

Eighteen specimens, from small creeks emptying into Rio Tiliri above Caen, Costa Rica, (including two specimens, C. M. Cat. Fishes, No. 8568); ten specimens from San-San Creek tributary to Rio San-San, (including one specimen, C. M. Cat. Fishes, No. 8569); two specimens from Rio Sixaola, upper Panama.

The majority of these fishes were sexually mature, and showed striking secondary sex coloration. The few very small specimens seem not to be mature, and in these the color was something intermediate between males and females. I have referred my specimens to the genus and species *Herotilapia multispinosa*, noting that the range of the anal spine count is greater than has been previously described. There have been so few specimens available as a standard for comparison that this reference seems justified.

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